Possible titles: **"Office Paper Efficiency: What You Can Do".**
"Paper In Your Office: What Can You Do?"
"Paper Efficiency: What It Is and What You Can Do".

[*needs:*
- More references to the *Energy Star* program.
- To be refined and graphically produced.]

Introduction

Paper is a wonderful material, and has played an important role in the development of our modern civilization. However, we can have too much of a good thing, and often find ourselves surrounded by more paper than we'd like, costing too much money, putting undue pressure on forests, and eventually needing to be disposed of as waste. This document discusses the type of paper we use in offices in copiers, computer printers, and fax machines, and some strategies for reducing its cost and quantity, that is, making your office more ***paper efficient***.

This document is oriented towards the general public and interested office worker who wants to change paper use practices in her or his organization. See the "Further Resources" section for more detailed information.

Background

Every year, the United States consumes over 90 million tons of paper. This paper use is an average of nearly 700 pounds per person, over ten times what it was at the turn of the century. The overall paper industry constituted $129 billion of our economy in 1993.

Our interest here is limited to that kind of paper used in photocopiers, computer printers, and fax machines. We'll call it 'copy paper', to distinguish it from the many other kinds of paper also used in offices, such as catalogs, cardboard boxes, and tissues. The annual use of this single type of paper is about 3.5 million tons, or 27 pounds per person. Paper prices rise and fall, but at average prices we spend about $3.5 billion per year buying copy paper. Most copy paper is used in offices, and the average office worker uses about 10,000 sheets per year, though many use considerably less and some much more.

Some facts about U.S. paper use

- Paper Consumption in 1993 was 91.4 million tons, with paper production at 86.6 million tons, with the difference made up by net imports; the value of the paper industry output was $130 billion (paper' here includes paperboard).
- Printing and Writing paper consumption was about 27.8 million tons (not counting 12.8 million tons of newsprint), with about 3.7 million tons of this copy paper. An additional 1.9 million tons was forms paper, much of it computer printout.

- The U.S. had about 30% of worldwide paper-making capacity in 1991, and the paper industry accounted for just over 3% of all U.S. energy use.

"The average office worker uses about 10,000 sheets per year of copy paper, at a cost of about $50"

How much paper is 10,000 sheets? In one large stack, 10,000 sheets of unused paper rises just over 4 feet (for a variety of reasons, as you use paper it takes up more space), and weighs about 100 pounds. Spread the paper out and you could cover the floor of a 10 foot square office 65 times, or a 3 by 6 foot desk more than 360 times. For every hour worked, about 5 sheets are used. At a typical volume price, this might only cost $50 to buy, but as we'll see later, buying the paper is just one of many relevant costs.

Some time ago the idea of the 'paperless office' spread as a distant ideal; no doubt this had something to do with familiarity we all have with 'paperwork' and the perceived promise of electronic alternatives such as computers. Paper is far too useful and satisfying to want to get rid of it, or be successful if we tried. A paper efficiency approach acknowledges the usefulness of paper, but recognizes that we can still use considerably less of it than we now do.

Increasing paper efficiency will usually be quite separate from office paper recycling programs. Successful efficiency efforts will inevitably mean less material collected for recycling (and less put into landfills as well). Recycling goals and programs will need to be adapted, but recyclers understand that it is better to make less waste than to produce more and recycle it.

Useful Facts about Copy Paper

- "Standard" U.S. office paper is 20 lb weight (in metric 75 g/m^2); each sheet is 8.5 x 11 inches and covers about 0.65 ft^2.
- There are about 200,000 such sheets in a ton (or about 220,000 in a metric ton). There are 100 to a pound and about 6 per ounce. A ream of such paper is 500 sheets, so there are 400 reams per ton, and each ream weighs 5 lbs.
- Paper prices vary, but a typical bulk cost is $1,000/ton, which is $2.50 per ream of 500 sheets, half a cent per sheet, 50 cents per pound, or 3 cents per ounce.
- A ream of unused paper is about 2 inches thick, so there are 250 sheets per inch, 3,000 sheets per foot, and each sheet is 0.004 inches thick.

What is Paper Efficiency?

1996 marks the 25th anniversary of the first copier with an automatic "duplexing" feature (duplexing is copying onto both sides of a sheet). Most people have made duplex copies at one time or another, but today, most copies are still single-sided. Duplexing some of these copies that are now single-sided is a way to get the same

information on fewer sheets of paper, and so an example of improving "paper efficiency".

Another example of paper efficiency arises when copying a book. In many cases, one can copy two book pages onto one side of a 'standard' (8.5 x 11 inch) sheet, particularly if the 'percent reduction' feature of the copier is used to reduce the size of each page. Use of both strategies together (duplexing and putting two original pages on each copied page) can avoid up to three of every four sheets.

Paper efficiency is much like energy efficiency. A more efficient car needs less gas to go the same distance as a less efficient one. Adding insulation to the walls of a house will reduce the heating (or cooling) bill and also make the house more comfortable to be in. Just as energy efficiency is not about "freezing in the dark", improving paper efficiency does not involve doing without the information on the paper.

The key to efficiency is that we usually don't want the paper itself, but the *service* that it helps to provide (for example, we buy a newspaper for the news it contains, not for the newsprint). Because of this rarely focus our attention on the paper itself, and organizations don't have a "Paper Department". Instead, every part of an organization uses some paper in delivering their product, but only as a medium. By spending some time to examine and rethink our use of paper, we can do a favor for ourselves, our organization, and the environment, by using it better.

> **"We usually don't want paper itself, but the *service* that it helps to provide".**

Why Should I Be Concerned About Paper Use?

There are many reasons why you might be interested in reducing the amount of paper you and those around you use. These can be broadly divided into environmental, economic, and other advantages. While many of the reasons are compelling, often the dollar savings are most influential. People will need to spend some time and perhaps some money changing paper habits, and so need to know that it is a wise investment to justify it to themselves and to others.

Regarding the environment, a common motivation is concern for landfills; even with the presence of effective recycling programs, a considerable amount of paper still ends up in landfills, and some fibers are lost with each round of recycling. Paper also takes a considerable amount of energy to produce, and while much of this is derived from the trees themselves, there is still a significant energy benefit to reducing paper use. The role of paper in global climate change (forestry, paper production, use, and disposal) is complex, but it appears that reducing paper use helps alleviate our climate problems. Producing paper has land-use and forestry impacts, and the pulping, bleaching, and papermaking processes produce a variety of harmful emissions.

Energy Used in Making Paper:

It takes the *equivalent* of about 17 Watt-hours (*Wh*) of electricity to make a sheet of paper from wood (and about 12 *Wh* for 100% recycled paper). This means that the manufacturing *energy* for the 5 sheets an hour typically used by office workers is about the same as that needed to run an 80 W bulb. However, the *cost* of the paper is close to the electricity cost of four 80 W bulbs.

"Your Organization probably spends over ten times as much money *using* office paper as it does to buy it."

On economic front, the U.S. as a whole spends a considerable amount of money buying paper, and an even larger amount in the course of *using* this paper. This is particularly true for office paper, where costs such as printing, copying, storage, and mailing overwhelm the paper purchase cost. Saving money by reducing some of these expenditures is an important rationale for reducing paper use.

A third type of benefit of better use of paper is the qualitative effect on our businesses and lives. Whenever you have to carry stacks of paper a distance (such as when traveling), you become aware that having less of it to lug around makes life easier. When we have fewer sheets of paper in our homes and offices, we will spend less time looking for those that are mis-placed or lost. Businesses are increasingly converting to electronic form, operations that had previously been paper-based. Many have found that the *quality* of information processing increases and the time it takes (both labor and total elapsed time) to process or summarize information drops precipitously.

As individuals and as employees within organizations, we should always remember that reducing paper use brings a whole set of benefits. Some changes may have little effect on overall costs, and so environmental benefits can be the main motivation. In other cases, the dollar savings by themselves are compelling and so can take the lead.

What Can You Do?

Once you've decided to improve your paper efficiency, the question arises as to how specifically to accomplish this. What you can do depends on the kinds of uses of paper in your vicinity, the level of efficiency already present, and your authority and ability to make changes. While some improvements can be made in many offices, there are probably some unique to your organization. Some changes are clear and obvious, with others less certain, or complicated to bring about.

The initial step should be an inventory answering the question: "How is paper used in my office?" The inventory can be short and general, extremely detailed, or (most likely), somewhere in between. In the process of collecting this data, you are likely to discover possible improvements, or have others tell them to you. A paper use inventory is never "finished", but only developed to greater detail and updated over time.

"The initial step is to answer the question: 'How is paper used in my office?' "

As your inventory takes shape, you can begin to identify and implement changes to improve your paper efficiency. Ideally you will observe the results of the changes in less paper purchased and other costs reduced. However, effects often take time to show up and other changes (e.g. in business conditions, equipment, or operations), can obscure the effect of efficiency changes.

Throughout this section will be examples of a hypothetical ACME, Inc.,. You might use some of the figures from ACME as a guide in estimating your paper use patterns when data for your organization are not available.

ACME: Introduction

The offices of ACME, Inc. have about 100 full-time equivalent employees, all office workers, in one location. ACME annually buys and uses about a million sheets of copy paper, or 5 tons, at a cost of about $5,000.

Useful terms and Duplexing Calculations

Paper statistics can become confusing at times; to reduce ambiguity, this document uses **sheets** to mean the paper itself, and **images** for the content on one side of a sheet (so that a sheet copied on both sides will have two images). Since **pages** could refer to either, it is best to avoid that term.

Duplexing is copying or printing on both sides of a sheet of paper. The **duplexing rate** is the percentage of images that are duplexed. Thus, imaging with a 100% duplexing rate will use half the paper that a 0% duplexing rate requires.

*Sheets = Images * (1-(DupRate/2))*
Images = Sheets /((1-DupRate)/2)
*DupRate = 1-(Sheets/(Images*2))*

Basis weight, or **weight**: The weight of a certain number of sheets of a specific size of paper. The number and size vary by the type of paper, but for copy paper is the weight of 2,000 standard sheets.
A **ream** of paper is 500 sheets. A **box** or **case** varies by the type of paper, but for copy paper is usually 10 reams.
Half-used paper has been used on one side, with the other side blank.

Measurement Strategies

As Figure 1 shows, there are many paper flows through an office, with the various streams joining and separating. Each sheet passes through several important stages, and it can be measured at any of these; try to measure all of them. As you inventory paper, try to gather the:

- Number of units involved (e.g. reams of paper, number of toner cartridges)
- Weight/mass of the paper (pounds or tons)
- Number of images made (and calculated duplexing rates)
- Dollars involved (e.g. for purchasing, copying, or mailing)

Following are some strategies for paper measurement in purchasing, printing & copying, faxing, mail & shipping, storage, disposal, off-site imaging, and high-volume uses.

Purchasing:

Most organizations buy large quantities of a few kinds of paper and small quantities of many kinds. With luck, you can locate all the information for the few, large kinds, and perhaps just an overall dollar estimate for the rest. If your purchasing department can't help, sometimes the distributor you buy from can provide the information (after all, it is their business to know about paper purchases, while it isn't one of your organization's core interests). If you can't locate all the information, consider making informed estimates from knowledge you have or by asking people. Often someone will know rough quantities such as that they buy "8 boxes every 2 months". When you see a label on a ream of paper, consider taking one for reference, as they usually list the brand, type, size, and weight.

Be aware that some paper purchases may be 'hidden'. For example, some copying jobs may be contracted out because they are particularly large, or have special requirements such as color imaging, large-size copies, special paper, or particular binding or folding needs. These are probably only worth tracking down when particularly large, or when done on a regular basis. If you have a print shop or copy center within your organization, they may have special ways of buying paper, and also may have better knowledge of the paper they buy than does the purchasing department that buys all kinds of products.

Copy paper varies in price, but a good estimate is $1,000 per ton, which is $2.50 per ream, 50 cents a pound, and half a cent per sheet.

"Copy Paper costs about $1,000 per ton, or 50 cents per pound."

ACME: Paper Purchase

Last year ACME bought:

Type	Reams	C.F.	Ream-eq.	tons	$/ream	$/ton	$/year
8.5x11	1,500	1	1,500	3.75	2.50	1,000	3,750
8.5x11 letterhead	40	1	40	0.1	15.00	6,000	600
8.5x14 (legal)	40	1.22	49	0.12	3.50	1,170	140
11x17	5	2	10	0.025	6.00	1,200	30
Color/InkJet	20	1.2	24	0.06	7.50	2,500	150
Formfeed CPO	10	6	60	0.15	12.00	800	120
Total			1,683	4.208		1,140	4,790

Notes: "C.F." is the Conversion Factor, to convert from reams to equivalent mass of standard paper. "Ream-eq." is "ream-equivalents". The "Color/InkJet" paper is high quality 24 lb paper. The "Formfeed CPO" is boxes of green-bar 11x14 computer printout paper.

Printing and Copying:

To understand how paper is used in your photocopiers, computers, and fax machines, you'll first want to know what types of equipment you have that are in common use. If your organization is small enough, you can simply walk around and write down the brand and model number of each device; in a larger organization, there

may be inventory or leasing records (many copiers are leased rather than bought). With luck, there will be a few models of printers and copiers that will make up most of the stock of machines. Try to locate the operating manuals for these models, as they may have information useful to you later on. Each machine has a rated 'capacity', which is the maximum number of images the manufacturer recommends that it make per month. Most office equipment is used at rates well below its capacity, often 15% of it. So, even if a copier is rated at 50,000 images per month, it probably makes closer to 10,000. There are probably a few pieces of equipment that are hardly used; make life simpler and don't bother with counting their paper use, unless they are particularly expensive to operate (such as some color printers or copiers).

Along with capacity, it is important to know the rated imaging speed. Machines don't necessarily run at the rated speed, either ever, or under ordinary use, but speed is a good way to categorize machines.

ACME: Imaging Device Survey

Copiers:

Acme leases their copiers, paying 2.5 cents per copy, which includes servicing, toner, etc. Last year the copiers were used at the following rates.

ID/ Speed	Monthly Capacity	Monthly Images	% of Cap.	Annual Images	Duplex Rate	Annual Sheets	Annual Cost
A: 50	70,000	10,000	15%	120,000	18%	109,200	$3,000
C: 50	70,000	15,000	23%	180,000	18%	163,800	$4,500
B: 50	70,000	20,000	30%	240,000	18%	218,400	$6,000
C: 30	30,000	10,000	33%	120,000	10%	114,000	$3,000
D: 10	10,000	2,000	20%	24,000	0%	24,000	$ 600
Total	**180,000**	**42,000**	**23%**	**684,000**	**16%**	**629,400**	**$17,100**
Copy Shop: Regular Copies				180,000	40%	144,000	$9,000
Copy Shop: Color Copies				2,000	0%	2,000	$2,000
Architectural Drawings (8.5x11 equiv.)				10,000	0%	10,000	$2,500
Total				**876,000**	**21%?**	**785,400**	**30,600**

Computer Printers:

Speed	number of machines	Sheets/year /machine	Total	
Medium	4	30,000	120,000	17 ppm
Low	12	2,000	24,000	4 and 8 ppm
InkJet	4	1,500	6,000	two are color
Total	**20**		**150,000**	

Fax Machines

8 machines, 4 fax modems. Fax phone bill is $8,000/year. From fax machine activity reports, the phone cost is typically 20 cents per sheet, so the estimate is 40,000 sheets per year.

Another source of data is image counters found on many devices. Laserprinters often print a sample output sheet when turned on, and some of these often have the number

of images they have made in one corner. By collecting several of these (from the same printer) some time apart, you can see how much it is printing. You may have turned this "feature" off in a previous efficiency effort, but a printer "self-test" will probably produce the same sheet. Copiers usually have a counter inside that records the number of images made, and as with the printers, you can see how much it is used, by simply subtracting an early count from a later one.

You are most likely to have information about image counts, so to arrive at estimates of paper use, you need a duplexing rate for each machine. All imaging equipment is rated by the number of images made per minute of operation. Estimates of national average duplexing rates are shown below. For laser printers, they essentially never can duplex for machines less than 10 pages per minute (ppm); rarely for 10 to 20 ppm; sometimes for 20-30; and usually for machines that operate faster than 30 ppm.

National Average Duplexing Rates For Copiers:

Segment	Speed	Duplexing Rate
PC	<10	0.0%
1	10-19	1.8%
2	20-30	4.6%
3	31-45	11.0%
4	46-69	18.0%
5	70-90	38.0%
6	>90	55.4%

Source: BIS, Inc., Boston, MA, 1991.

Another aspect of imaging on paper is the toner (ink) and equipment maintenance. Copier toner and maintenance is often 1 to 3 cents/image. Laser printer cartridges are often 1 to 2 cents/image, with ink jet printer costs similar. You can use the amount of toner or ink bought as an indication of the number of copies made. However, you might use it considerably slower or faster than average, so use such estimates cautiously.

Fax Machines

Faxes are an interesting case in that the person who sends the fax doesn't use extra paper (except if there is a confirmation sheet), but the sender incurs most of the cost in the form of the phone charge. Many fax machines take about 40 seconds to send each page, though you can easily time your machine on several faxes to confirm this. You may find, or be able to generate, periodic reports of fax activity; these can provide records of pages per week for both incoming and outgoing faxes, and an indication of the balance among local, long-distance, and international faxes (which indicates cost). Your phone bill for the fax line may indicate total transmission time, which, divided by the time per sheet, indicate pages sent. While the sheets of paper used is due to the incoming (not outgoing) faxes, you can observe the ratio between these from activity reports. Imaging costs for fax machines are similar to those for printers (except sometimes for thermal fax machines)

Mail/Shipping

The weight of first class mail sent in the U.S. is about half that of the copy paper we use. While most of this mail is not copy paper, the amount of copy paper that is mailed is still considerable. For a letter between 1 and 11 ounces, the extra ounces (23 cents per ounce) cost about $7,000 per ton, or seven times the cost of buying paper. The first ounce is about $10,000 per ton. Thus, avoiding mailings or reducing the weight can be a significant cost savings. The following table presents two examples of reduced paper and postage costs from duplexing. In the last column, the number of sheets is reduced enough so that the mailing can be folded in three and so use a smaller, lighter envelope.

Savings from duplexing First Class Mail

	Fifty Pages		Thirty-Four Pages		
	Simplex	Duplex	Simplex	Duplex	Duplex & Envelope
Images	50	50	34	17	17
Sheets	50	25	34	17	17
Weight (oz)					
Paper	8.0	4.0	5.44	2.72	2.72
Envelope	0.6	0.6	0.6	0.6	0.14
Total	8.9	4.6	8.04	3.32	2.86
Cost (cents)					
Paper	25	13	17	9	9
Postage	216	124	170	101	78
Envelope	7	7	7	7	2
Total	248	144	194	117	89
Savings					
cents		104		77	105
Percent		42%		40%	54%
cents/sheet		4.2		4.5	6.2

"Extra ounces on first class mail cost $7,000/ton, or 3.5 cents/sheet".

Storage

Most of us store paper on our desks, on shelves, in filing cabinets, and perhaps in central long-term storage often away from our individual offices. With less paper around, you might be able to do with fewer filing cabinets, saving the cost of the cabinet and the floor space it occupies. Count, or estimate, the number of file cabinets you have and determine how much floor area they occupy (2.5 ft^2 is a common footprint). Multiply by the value of that floor area and you might get a cost from $25 to $100 per year for the space. Assuming 2,000 sheets/foot of file space, a typical 4-drawer cabinet might have a capacity of 16,000 sheets. Assuming it is just 75% full, it would contain 12,000 sheets or 24 reams. At $2.50/ream, this is $60 of paper, and so the value of the floor area is often comparable to an annual paper purchase cost of the paper in it. While the file cabinet lasts many years, it costs several times the cost of this paper, so is notable, but less than the paper or floor area cost. All of these usually

pale in comparison to the value of the time spent filing and retrieving papers from the file cabinet.

Disposal
With very few exceptions, every sheet of paper is eventually thrown away, most of it within a few years of first being used. Some office paper recycling programs record how much copy-type paper is collected, but you are unlikely to get this for the regular trash. However, you are unlikely to save much money on disposal compared to other dollar savings from paper efficiency. One exception can be if large amounts of paper are shredded to destroy the content on the paper. Shredding costs can vary, but $500 per ton is not uncommon.

ACME: Storage and Disposal

ACME has 140 file cabinets, each of which occupy about 2.5 ft^2 of floor area, for a total of 350 ft^2. The annual rent for ACME's offices is $30 per square foot, so that the dollar cost of this space is $10,500 each year. Ten file cabinets wear out and are replaced each year at a cost of $1,500. Thus, the combined storage cost is $12,000 per year.

The local landfill charges $50 per ton of material placed in it and this figure is used, which for the five tons of paper amounts to $250. Some paper is taken away for free to be recycled, and hauling costs add considerably to the disposal costs, but these are assumed to cancel each other out. A separate cost is that about 20% (1 ton per year) f ACME's office paper is sent out for shredding to protect customer confidentiality, at a cost of $500/year.

Off-site imaging:
If your organization utilizes a considerable amount of off-site copying, examine some invoices or phone the business to estimate a typical duplexing rate, cost per image, and cost per sheet. Then, apply these to the annual budget for off-site imaging to estimate the total amount of paper from this source.

High-Volume Uses:
Some uses of paper are 'industrial' in their scale. Examples of this are printing bills for customers, producing accounting, inventory or financial reports, or processing large numbers of forms or invoices from customers. While these are probably already more efficient than other office paper uses, it is still worth examining for improvements as the amounts of paper and dollars tend to be so large.

Once your data are all collected, you can present a "paper budget", showing where it comes from, how it is used and where it ends up, both by mass and dollars. You can report the cost per ton for each activity. When more organizations report such data, you will be able to compare your use and costs with others—particularly those in the same industry—and see how you compare.

ACME: Paper and Cost Inventory

Summary	Sheets	Cost	Notes
Paper Purchase		$ 4,790	4.208 tons

Internal Copying	629,400	$17,100	plus $3,000+ paper purchase cost
Outside Copying	156,000	$13,500	
Printers	150,000	$ 4,000	$1,500 supplies ,$2,500 eqt.; plus $500 paper
Fax Machines	40,000	$ 8,800	$8,000 phone, $800 toner; plus $200 paper
Mail		$ 8,000	
Storage		$12,000	
Disposal/Shred.		$ 750	
Total	975,400	$60,940	

Note that the paper purchase identified here is 4.1 tons, compared to 4.2 tons used (apart from the outside copying, since the copy store buys that paper). The close agreement is probably deceiving, as some paper inevitably gets damaged before being used, taken home by employees, or otherwise not used as anticipated, so the image counts may be slightly too high or the duplexing rate slightly too low. Nevertheless, these data present a good overall picture of paper use patterns within the company.

The attached pie charts shows the distribution of paper used in imaging equipment as well as the distribution of dollar costs of paper purchase and use.
a second pie chart of Paper Use Costs (by $$).

If you come up with interesting results or observations, consider sending them to 'paper@dante.LBL.gov'.

Action Steps (Efficiency Strategies)

Strategies for improving paper efficiency often apply across many types of use, such as duplexing on copiers and laser printers. Dollar savings (per ton) vary considerably, with some only saving paper purchase costs and others saving much more.

Duplexing:
One of the most effective ways to reduce paper use is using both sides of a piece of paper rather than just one, that is, duplexing. While we often do this already, we could be doing it considerably more. With duplexing, one saves money on buying paper and on storage and mailing. It is also easier to fold and staple, and to carry around. While some prints and copies need to be single-sided, most do not.

High speed copiers and computer printers nearly always have extra hardware for duplexing, and low speed machines almost never do. If you are buying a medium speed machine (21 to 44 copies per minute—cpm), be sure that you get one with a duplexing unit. Copiers are available that can be set to default to duplex so that you don't need to remember to set the duplex mode on; this is a requirement of the EPA *Energy Star* program for large copiers.. Some copiers duplex better than others; ask sales people to explain to you why the machine they are offering duplexes better than competing models. Duplex copying is often slower than single-sided copying; if the speed reduction is too much, many people will avoid duplexing, so ask about copying speeds for a variety of modes. Low paper jam rates while duplexing is also an attribute to look for. If you buy many copiers, consider one of the services that tests machines and reports how well they work.

Because higher capacity equipment is usually better for duplexing, consider having fewer, larger printers and copiers. You can often save money on the initial cost of the equipment and on operating costs. If your office has a computer network, consider replacing several small printers with one large printer that defaults to double-sided output (this avoids the need to have the software work well with duplexing), and one smaller, older, printer for single-sided output.

Paper Reuse:
Another paper efficiency strategy is to reuse paper that has already been imaged on one side (by a printer, a copier, or outdated letterhead), but has a clean second side (this is "half-used" paper). Avoid paper that is folded, torn, or dirty, and be sure to take off any staples, paper clips, or Post-Its®. Some people think that half-used paper will damage the output device, but many people have reported successfully using half-used paper. Fax machines are a good candidate for half-used paper as they almost never have duplexing units and fax output is almost always strictly for internal use (not mailed). If there are several laser-printers in an office, one can be designated as a 'draft' printer and always be stocked with half-used paper. If half-used paper is particularly curled (from a laserprinter), you can remove most of this by putting a heavy weight (e.g. several phone books) on a stack of it for a few days or weeks.

Image Reduction:
The ability to reduce or enlarge images is common on copiers. When copying a book, one can often get two original pages on to one side of the copied sheet. Because reduction works in two dimensions, you only need reduce by 30% (to 70%) to cut in half the area of an image. While reproducing entire standard pages requires a 35% reduction (to 65%), books often have smaller than standard pages and most documents have larger than necessary margins, so the reduction can usually be less than this.

Image reduction is also possible with printing. Many word processing and presentation preparation applications can print two, four, or more "pages" on each output page. Often this is called "2-up", "4-up", etc. printing. With the high quality of current printing technology, considerable reduction is possible while maintaining readability. Also while printing it is possible to reduce margins between the text and the edge of the page, and reduce the point size used. This is particularly useful for widely reproduced documents, and when small changes can avoid an additional sheet of paper. Image reduction saves imaging costs as well as paper costs, so that every pound of paper avoided saves considerably more than does a pound avoided through duplexing (for example).

"Image reduction saves on imaging costs, which are much more than paper purchase costs."

For example, consider a printer costing 2.5 cents/image and paper at 0.5 cents/sheet. A 4-page document would cost 12 cents traditionally, which could be reduced to 11 cents by duplexing, 6 cents by "2-up" printing, or 5.5 cents with both.

Image Avoiding:

The savings are largest for those images that can be avoided entirely. Simple examples of this are fax cover sheets, confirmation sheets, and printer cover pages. Often there are alternatives such as fax summaries that record many transactions on one sheet, or placing document identifiers (date/time, file name, or owner) on the document rather than on a separate cover sheet. For more than minimal use, avoid thermal fax machines as the resulting output is often copied onto regular paper and so increases paper use and imaging.

Paper Thickness:
Most copy paper is "20 pound" paper, which in this case is the weight of 2,000 sheets. InkJet printers and color copiers often use 24 lb paper, for better imaging, and letterhead paper is also often thicker than 20 lb. If you use a large amount of greater than 20 lb paper, consider and possibly test thinner paper. There are some applications for which 16 lb paper is appropriate, particularly those unlikely to be duplexed (such as fax machine output). Some imaging equipment is not rated to use paper that thin (though it may still work satisfactorily), and even if it does, thin paper may not hold up in use, particularly if it will be subsequently put through a copier document feeder. A promising alternative is 18 lb paper, though this is as yet not widely available.

Imaging Savings:
Some strategies don't save paper at all, but are still worthwhile. Many inkjet and laser printers have 'economy' or 'draft' modes that use less toner than is standard. This can save on ink/toner costs, which can be as large or larger than paper costs. In addition, some printers operate faster in such draft modes.

What might the future hold?

There has been a consistent trend of more imaging shifting from copying to printing. Fax machines are a good example of this, in that when an image might previously have been copied and mailed, now it is scanned, transmitted, and printed by a fax machine. More and more of what we "copy" will be documents that are on-line and so printed instead. As copiers shift to digital processing, the distinction between printing and copying will diminish. There are available "multifunction" devices that can fax (in and out), scan, print, and copy, though these are mostly low-speed devices. As imaging devices become cheaper and more widely spread, there may be more imaging done on devices that can't reasonably duplex automatically (though manual duplexing may remain an option).

> **"As copiers shift to digital processing, the distinction between printing and copying will diminish."**

Improvements in electronic data management will likely mean eventual reductions in the amount of copy paper we use, but how much and when is unclear.

Conclusion

The paradoxes of paper are that while it is not too expensive to buy, it is considerably more costly to use, and that while each sheet is quite cheap, we use enough of them to make the total a considerable cost. The improvements you can make in your own paper use are likely to be straightforward and mostly use technology already present in your office. Don't worry if most of your solutions seem mundane or unsophisticated. While you may find it useful to assess the environmental benefits of using paper better, always make sure to count the dollar benefits (all of them), as someone else will want to know.

Additional Resources

Should ref Waste Wise

Send people to NOPRP for recycling

Would it be appropriate to refer people to BLI? to BLI competitors if they have any?